SECTION 15150

SEISMIC RESTRAINT FOR MECHANICAL SYSTEMS & EQUIPMENT

PART 1 GENERAL

1.1 Related Documents

A. All sections of Division 1.

B. Examine all drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section. Work shall be coordinated with other trades prior to installation to prevent interference and relocations.

1.2 Description of Work

A. The requirements for seismic protection measures to be applied to equipment and systems specified herein are in addition to any other items called for in other sections of these specifications.

1.3 Quality Assurance

A. Manufacturer's Qualifications, firms regularly engaged in manufacture of seismic restraint products, of type, size and capacity required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:

1. BOCA Basic Building Code with Supplement, adopted and enforced edition. *1987?*

2. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems, latest edition. *date*

3. ASHRAE HVAC Applications Handbook, Seismic Design, 1995 edition.

1.4 Mechanical Equipment

A. New building equipment requiring seismic restraint shall include the following items indicated on drawings or in other sections of these specifications:

1. Cabinet Unit Heaters and Unit Heaters

2. Fan Coil Units

3. Compression Tanks

4. Hydronic Heat Exchangers

5. Environmental Control Units

1.5 Mechanical Systems

A. New building systems shall include the following new work indicated on drawings or in other sections of these specifications (except where excluded in this section):

1. Heating Water, Steam and Condensate Systems

2. Domestic Water Supply Systems

3. Sanitary Drainage and Venting and Storm Drainage Systems

4. Ducted Air Systems

1.6 Seismic Zone

A. This facility is located in Seismic Zone 1* as defined in the 1987 BOCA Basic Building Code.

1.7 Seismic Hazard Level

A. This facility shall be provided with seismic restraint in accordance with Seismic Hazard Level (SHL) C* requirements as published by the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).

1.8 Exclusions

* A. Seismic protection of water pipes for fire protection systems shall be installed in strict accordance with the provisions of NFPA 13 and Appendix A thereto as specified in division Section 15, "FIRE PROTECTION".

B. Seismic restraints may be omitted from the following installations:

1. Piping in mechanical equipment rooms less than 1¼" inside diameter.

2. All other piping other than that located in mechanical rooms, less than 2½" inside diameter.

3. All rectangular air handling ducts less than 6 square feet in cross sectional area.

4. All round air handling ducts less than 28" in diameter.

5. All piping suspended by individual hangers 12" or less in length, from top of to bottom

of the support for the hanger.

6. All ducts suspended by hangers 12" or less in length from the top of the duct to the bottom of the support for the hanger.

1.9 Submittals

A. Mechanical Systems Seismic Restraint Shop Drawings: Detail drawings of the SMACNA Guidelines and additional installation details, as appropriate, for the seismic restraints required shall be submitted. Submittals shall be complete in detail; shall indicate thickness, type, grade, class of metal, and dimensions; and shall show construction details, reinforcement, anchorage, and installation with relation to the building construction.

B. Mechanical Equipment Seismic Restraint Shop Drawings: Detail drawings and installation details, as appropriate, designed and stamped by a licensed Professional Engineer in structural design, for the seismic restraints required shall be submitted. Submittals shall be complete in detail; shall indicate equipment restrained, thickness, type, grade and class of metal, and dimensions; and shall show construction details, reinforcement, anchorage, and installation with relation to the building construction.

C. Plans showing all locations for seismic restraint of mechanical systems and equipment with cross references to types of restraints included in the seismic restraint shop drawings.

PART 2 - PRODUCTS

2.1 Materials and Equipment

A. materials and equipment shall conform to the respective specifications and other requirements specified below:

1. Cold-formed angles shall conform to the material and identification requirements of the latest "Specifications for the Design of Cold-Formed Steel Structural Members" of the American Iron and Steel Institute with a minimum Fy=33 ksi and a minimum Fu= 38 ksi.

2. The uncoated minimum steel thickness of the cold-formed product as delivered to the job site shall not at any location be less than 95 percent of the thickness indicated. The thickness may be less at bends after cold forming.

Gage	Standard Uncoated Thickness (inches)	Galvanized Thickness (inches)
12	.1046	.1084
14	.0747	.0785
16	.0598	.0635

3. Hot-rolled shapes and plates shall conform to ASTM A36. Pipes used as braces shall be Standard Steel Pipes ASTM A120 or A53.

4. Cables shall be wire-core with a minimum breading strength as specified. Cable shall be zinc-coated to a minimum of 0.4 ounces/square foot or stainless steel per ASTM A304. Tighten cable only to remove excessive slack.

Size (inches)	Breaking Strength (pounds)
1/4	4,940
3/8	10,980
1/2	19,260

5. Bolts shall conform to ASTM A325. Bolt holes shall be 1/16" larger than the bolt diameter unless noted otherwise.

6. Expansion anchors shall have values equal to or greater than both the shear and tension capacities listed. Cast-in-place concrete inserts may replace expansion anchors where the approved loads are equal to greater than the values for the specified expansion anchors.

Size (inches)	Shear Capacity (lbs)	Tension Capacity (lbs)
3/8	675	615
1/2	1,130	1,040
5/8	1,580	1,535
3/4	2,270	2,020
7/8	5,060	3,705

7. Welding Shall conform to AWS D1.1 and shall use either shielded or submerged arc methods.

PART 3 - EXECUTION

3.1 Mechanical Systems Bracing

A. All ductwork and piping which is not excluded from seismic restraint as specified in this section shall be provided with seismic restraint in accordance with Seismic Hazard Level (SHL) C* of SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.

3.2 Equipment Bracing

A. Equipment bracing shall be provided for all items supported from floors on roof structures or suspended from the structure. Braces shall consist of angles, rods, bars, or pipes secured at both ends with not less that 12 inch bolts. Bracing shall be provided in two planes of directions, 90 degrees apart, for each piece of equipment. Sufficient braces shall be provided for equipment to resist a horizontal force equal to 15 percent of the weight of the equipment without exceeding safe working stress of bracing components. Details of all equipment bracing

shall be submitted for review. In lieu of bracing with vertical supports, these items may be supported with hangers included at 45 degrees directed up and radially away from the equipment and oriented symmetrically in 90 degree intervals on the horizontal plane, bisecting the angle of each corner of the equipment, provided that supporting members are properly sized to support operating weight of equipment when hangers are included at a 45 degree angle.

END OF SECTION 15150